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PILOT STUDY ON READING PROBLEMS DUE TO VISUAL DISABILITY.

BY- YVONNE, SISTER M.
MARYGROVE COLL., DETROIT, MICH.

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A STUDY ON THE USE OF THE OCULARMOTOR TRAINER (O.T.) TO IMPROVE READING ACHIEVEMENT, BY LESSENING READING DISABILITY IN LEFT-TO-RIGHT DIRECTION AND RETURN SWEEP, WAS REPORTED. MATCHED PAIRS WERE ESTABLISHED OF 20 PUPILS WHO WERE RANDOMLY SELECTED FOR EXPERIMENTAL AND CONTROL GROUP ASSIGNMENT. THEY RECEIVED READING THERAPY FOR 15 WEEKS. THE EXPERIMENTAL GROUP RECEIVED AN ADDITIONAL 10-MINUTE PERIOD OF OCULARMOTOR TRAINING DURING EACH SESSION. PRE- AND POST-TEST PROCEDURES WERE ADMINISTERED FOR ORAL AND SILENT READING ON EQUIVALENT FORMS OF THE READING TESTS. THE RESULTS INDICATED THAT TRAINING ON AN O.T. RESULTED IN GREATER READING ACHIEVEMENT THAN BY CONVENTIONAL PROCEDURES. SINCE THIS PILOT STUDY WAS LIMITED, IT WAS SUGGESTED THAT THE STUDY BE REPEATED ON A LARGER SAMPLE AND FOR A LONGER PERIOD OF TIME. (RS)

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TITLE

Pilot Study on Reading Problems Due to Visual Disability

Cooperative Research Project No. S-164

AUTHOR

Sister M. Yvonne, I.H.M.
Marygrove College
Detroit, Michigan 48221

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CHAPTER I

STATEMENT OF THE PROBLEM AND DEFINITION OF TERMS

The value of such a study is substantiated on the basis of current literature and recent conferences. Surveys by Harris[1] indicate that approximately one-third of the elementary school children read at grade level, a similar proportion exceed grade placement by one or more years, and the remaining third are retarded one or more years.

A summary of many research studies by Bond[2] states that the per cent of seriously retarded readers, that is, those who are below grade level two or more years, from grades two through eight, ranges from ten to twenty-five per cent.

A well-known and significant fact is the tragic effect which reading disability has on many school-age children either in regard to their achievement or relevant to personality adjustment. Reading disability not only hinders progress in most content fields, but also frequently causes personal insecurity since the basic psychological need for successful achievement remains unfulfilled in the crucial area of reading. The student's inferiority feelings may be evidenced by either antisocial or social behavior, which, in turn, prevents normal participation in class activity. A common result of reading disability is the student's inevitable loss of self-confidence, interest in school and its values, and ultimately his dropping-out before high school

graduation. This latter effect, as we already know, has both educational and sociological implications.

Before probing into this particular area of research, a definition of terms is necessary for a common understanding of the problem. One could explain eye-hand coordination as the bilateral cooperation of the eyes with the hands. Marion Fenwick Stuart states that it means "activating eyes, ears, speech, touch, and motion in a simultaneous or in an interrelated way to establish concepts."[3] Marion Monroe[4] gives a more detailed explanation. She says that some children lack precision in motor control insifar as the children frequently lose the place, skip lines and words, and finger-point as a means of keeping the place.

A more thorough concept of eye-hand coordination was stated by Newell C. Kephart at the first annual meeting of the Perceptually Handicapped Child in April, 1963 when he said:

> The best illustration occurs in the field of vision. Here the control of the eyes and the head in relation to the object of stimulation determines what the input will be. Unless the eyes can be pointed at the object of regard, held there until all the necessary information is obtained and follow the object when it moves, the incoming information will vary. For the child, who at this stage cannot be aware of the nature of the difficulty, such variation can only be without rhyme or reason.
>
> Notice that it is not control of the external eye muscles "per se" which is important, but their control "in relation to the sensory information." The visual information itself must become the controlling factor in the muscle response. The coordination of the external ocular muscle itself is a neuromuscular learning process.[5]

From the above definition, it is evident that gross motor coordination is not a relevant factor. On the contrary, many children with poor eye-hand coordination skills are excellent in sports and manual skills.

Just as there many definitions and interpretations of the meaning

of eye-hand coordination, so too, are there many definitions of reading retardation. Since there seem to be as many ideas of reading retardation as there are authorities in the field, and because of the misunderstanding in popular literature, the writer will use Spache's[6] very complete explanation of reading retardation. A retarded reader is

> an individual who is retarded in a number of reading skills by one or more years, if in the primary grades, or two years or more if older, below that reading level necessary for full participation in the reading tasks of his age or socio-economic group.[7]

This definition may appear to be complex, but each phrase is essential. A retarded reader is deficient in a number of reading skills. A developmental program rather than special diagnostic steps are usually adequate in overcoming a difficulty in one skill.

A knowledge of the degree of retardation is helpful in determining corrective measures. Since the second grade child has only been reading for approximately a year and a half, one year of retardation means that the child will be reading only on a primer level, which poses a very serious problem. If this example is applied to an eighth grade level, a year of retardation is not serious because the child can still achieve in the academic subjects if he is reading on a seventh grade level. Two or more years on the upper elementary levels is significant.

Many poor readers try to compensate for their reading deficiency by oral class participation. After a few years of compensatory behavior, however, the reading tasks begin to "catch-up" with the student. Consequently, he can no longer participate fully in his class work. There may be varying levels of expectation, depending upon his peer

group and socio-economic level. Therefore, it is difficult to determine the quality of class participation. The expected goal is primarily dependent upon the class teacher and her evaluation of pupil participation.

CHAPTER II

OBJECTIVES OF THE STUDY

Records of approximately 625 subjects from the Marygrove College Reading Clinic files were examined for reading accuracy and coding scores. These subjects had been administered both silent and oral reading diagnostic tests, the Wechsler Intelligence Scale for Children, Audiometer, and Orthorater screening, and Leavell, Hand-Eye Coordinator Tests. The examination of records revealed that many of these subjects possessed very poor eye-hand coordination as measured by the Coding Subtest on the Wechsler Intelligence Scale for Children. On the basis of this observational study, it was hypothesized that a deficiency in eye-hand skills would relate to reading retardation. To verify this hypothesis, raw scores on the Gilmore Oral Reading Test, Form A for the most recently filed 200 subjects of the 625 were correlated with the Coding Subtest raw scores on the Wechsler Intelligence Scale for Children. The Pearson Product Moment method of correlation yielded a coefficient of .66, which is significant at better than a .01 level. Since this population constituted a select group, data was gathered on a normal population.

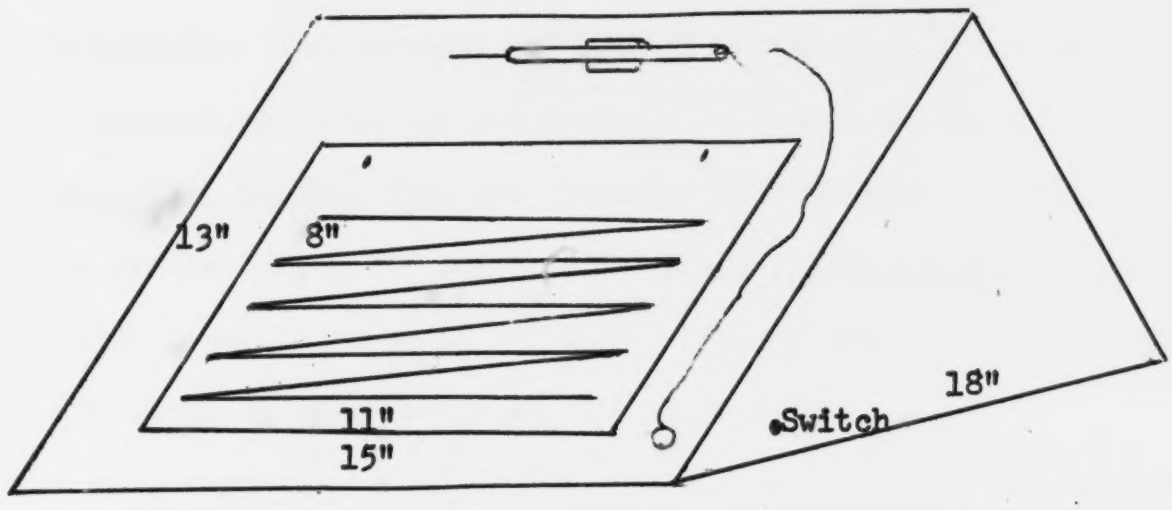
On the basis of this evidence, the writer designed, had constructed, and standardized a mechanical device for the testing and training of ocularmotor skills,

The Ocularmotor Trainer was standardized on a normal population of 800 subjects from six through thirteen years of age, whose birthdays

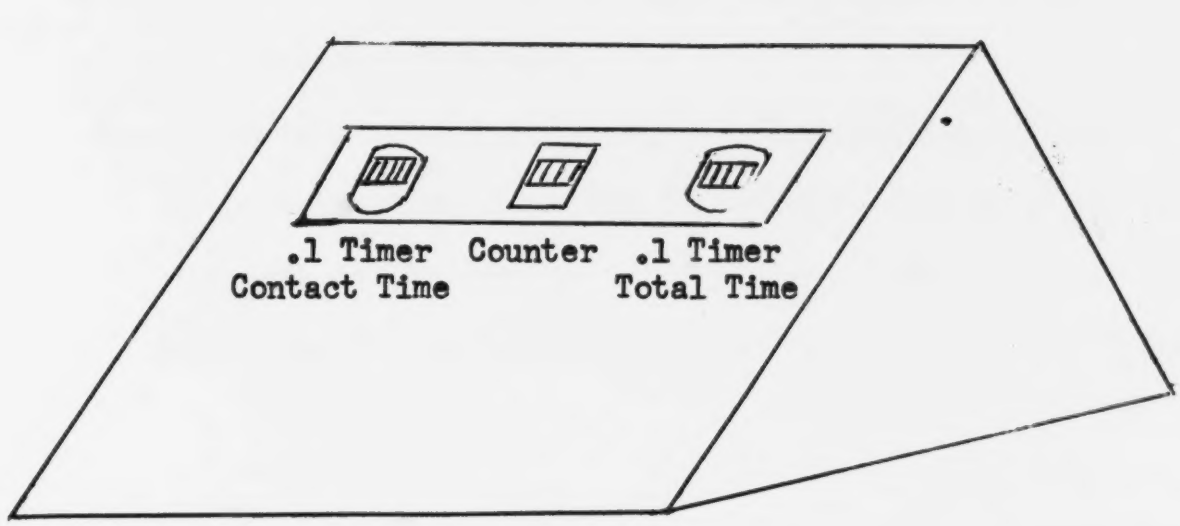
fall in the fifth, sixth, or seventh month from the date of testing.

The Ocularmotor Trainer has metal plates and stylus. The plates range in difficulty in order to provide increased precision of training in left-to-right direction and return sweep. Plate one is a half-inch track; plate two a quarter-inch track; plate three an eighth-inch track; and plate four a sixteenth-inch track. More plates are being devised for further training. Clocks measure to one-tenth of a second the total time required by each subject to complete a plate. A counter records errors, that is, the number of times the stylus contacts the metal plate. The subject moves the stylus across the metal plate on a nonconductive narrow surface from left-to-right and return sweep. The stylus, when moved from the nonconductive surface to the plate, causes immediate contact and activates the counter which records each contact with the plate. This is called an error. Throughout the study this is what will be meant by the term error. The subjects with whom this machine has been used have been highly motivated. Self-competition charted on individual graphs contributes to interest. Subjects check their own time and contacts. The Ocularmotor Trainer is sketched in Figure 1.

In order to determine the correlation on a normal population, one hundred elementary school children were tested individually for oral reading performance and eye-hand coordination skills. The Gilmore Oral Reading Test, the Ocularmotor Trainer Test, and the Coding Subtest of the Wechsler Intelligence Scale for Children were administered. The product-moment method of correlation was used to determine the exact



Front View



Back View

Figure 1. A visual perceptual skill aparatus, The Ocularmotor Trainer, constructed specifically for left-to-right direction and return sweep.

relationship. The research hypothesis states that there is a relationship between oral reading accuracy as evidenced by the raw score of the Gilmore Oral Reading Test and eye-hand coordination as shown by the raw score of the Coding Subtest of the Wechsler Intelligence Scale for Children. The risk level is taken at .01 level of confidence. In this study r is .71 which is significant at the .0005 level.

As a result of this preliminary experimentation, the following objectives were formulated for the present study:

1. To determine the excellence of Ocularmotor training over the usual procedures used in remedial reading work by pair-matching an experimental and a control group on the following variables: chronological age, intelligence rating, sex, race, and ocularmotor skills.
2. To improve reading achievement by correcting reading disability in left-to-right direction and return sweep by means of practice sessions on the Ocularmotor Trainer. These sessions will be approximately ten minutes an hour twice a week for fifteen weeks.

CHAPTER III

RELATED RESEARCH

The area of remotely or immediately related research is somewhat limited. The following research studies treat of the neurological approach to reading and the perceptual process in reading. Many of the references relate to the original study supplied by Samuel Orton, a neurologist, who, in 1928, suggested that reading retardation was due to a directional confusion, which, in turn, reflected the lack of a consistent dominance pattern, which

> might readily serve to explain the failure to differentiate between "p" and "q" and between "was" and "saw", and also to account for facility in mirror reading and mirror writing, and thus to explain those confusions of direction which have been extensively recorded in the literature and which as here described seemed to characterize all the cases of my own series.[8]

Orton's study presented very little data toward treatment and some toward the prevention of reading problems.

A study that followed Orton's study was one done by Marion Monroe in 1932. She observed that many of the children who were diagnosed for reading disability had difficulty in making the motor responses required in reading. She suggests that

> it would be desirable to obtain a measure of the precision of motor control necessary in reading and to compare the reading defect cases with the good readers. In the present study we did not attempt to measure motor precision but noted marked deviations whenever they occurred. In a number of cases the child's lack of precision in bodily control seemed to be one of the important concomitants of the

> reading disability and one we had to consider in the selection and application of remedial methods.[9]

No explicit findings resulted from this study because Monroe studied multiple causation of reading disability.

Between 1932 and 1949 little emphasis was placed on this area of research. With Krise Morley[10], the field opened once again. He designed a study with college students in 1949 which hypothesized that when confusion occurs with symbols which are identical when the background is disregarded, this confusion is due to lack of familiarity with the relationships between the various symbols and their background. For his study, he used four similar nonsense symbols in place of the vowels a, e, i, and o. He observed that these students had some difficulty in moving the eyes from left-to-right, and that there was no clear-cut unilaterality. He concluded that students simply find it difficult to differentiate between similar symbols.

It is probable that the smoothness of left-to-right directionality was lessened somewhat because of the unfamiliarity of the symbols rather than poor eye movement.

Five years later, Leavell[11] conducted an empirical study with children from eight to fourteen years old. He employed the use of an eye-hand coordinator, which was designed to develop left-to-right direction and eye dominance. It was used for two hours daily during a two-and-a-half month period. According to test results, phenomenal gains were made. Leavell concluded that general indifference or retardation in any one of the language skills is now recognized as the possible result of neurological confusion in visual and manual control

in unilateral function.

This conclusion appears to be general and broad in its scope. It hardly seems possible that retardation in any one of the language skills stems from neurological confusion. It would seem that if this is true, reading disability problems will soon be reduced.

Guy Bond, in 1957, quoted Monroe's earlier study and added further that

> Although direct causal relation between poor motor control and reading disability has not been clearly established, Gesell and Amatruda mention that muscular in-coordination and speech and reading disabilities may be due to slight birth injuries to the brain. Further evidence on this point is needed.[12]

There is more extensive data in the field at the present time.

A more recent study was published in 1957 by M.D. Vernon.[13] She found that five our of six cases of severe reading disability with average or above average intelligence, nevertheless manifested very poor performance on the Kohs Blocks Test. Vernon learned that poor performance on the Coding Subtest of the Wechsler Intelligence Scale for Children is sometimes observed in cases of reading disability.

> It is possible that it is a sign of lack of maturation. The normal reader may grow out of this immature type of behavior. But backward readers may fail to do so because they have not developed habits of orderly and systematic analysis of shapes into their essential constituents.[14]

The writer worked through an observational study using the Coding Subtest of the Wechsler Intelligence Scale for Children which has been previously mentioned.

A later study by Carl H. Delacato[15] in 1959 indicated that all approaches used for diagnosis and remediation of reading problems have

been peripheral in nature. He strongly advocated that the child be treated by the wholistic theory of diagnosis and remediation. By the wholistic method, Delacato is referring to "the neurological adjustments and the resultant loss in reading ability and language ability."[16] An example that Delacato cites is the following: if a child loses his vision in the controlling eye, his reading will probably suffer for a short time. The reading does not lie in that eye and yet is affected by this loss. Therefore, by using the periphery to implement the wholistic approach, language facility can be increased.

Spache refuted Delacato when he said:

> Delacato's attempt to change the "controlling" eye in binocular activities by training in monocular tests hardly seems logical. Such training might have some effect upon the preferred eye in sighting, or what is commonly called the "dominant"eye. But, according to Delacato, the dominant eye and the controlling eye are not identical. It is certainly not very clear how training which is most likely to effect eye-dominance is also effective in changing the "controlling" eye in a binocular task. In fact, Delacato fails completely to prove the existence of a "controlling" eye or, if this condition does exist, that it has any relationship to reading.[17]

Delacato firmly believed that reading problems need not exist at all, because they can be successfully prevented. He placed the first responsibility for prevention on parents, and secondly with teachers. With proper preventative measures in effect, this very serious problem can be eliminated from the educational scene.

Many authorities would disagree that all reading disability cases will disappear. Researchers have discovered multiple causes for reading failure which are due to physical, psychological, and intellectual factors.

More recently, Donald Smith and Patricia Carrigan[18] published a study in 1959 on the synaptic-transmission theory. They characterized the reading disability as:

"1. Severe blending deficiency.

2. Abnormally low reading rate of familiar material.

3. Deficient discrimination of sounds and visual symbols."[19]

Both hypothesized that these functional difficulties were due to an imbalance in the hormonal control of the transmission of neural impulses.

The subjects for this study, selected from a total population of about 4,000, were 701 children in grades three through nine in Ann Arbor, Michigan. Only those having scores below the twentieth percentile on the local norms for the Gates Advanced Primary Reading Test, as well as the California Reading Test qualified.

Diagnosticians administered individually fifteen tests providing eighteen scores. Results of these tests showed five clusters of syndromes: group 1 was low in both cognitive-associational skills and in perceptual-metobolic skills, group 2 was evenly balanced with neither high nor low skills except for low cognitive-perceptual skills, and group 3 did not present a clear pattern. Groups 4 and 5 were generally superior to the other groups.

The treatment studies of the individuals in these groups did not result in significantly greater gains in reading for the treated or control groups. Other favorable behavior patterns did occur, however.

An excellent outgrowth of this study, it seems, is that along with reading and psychological evaluation, a complete physical examination be included in a diagnostic evaluation. It is probable then, that more

basic physical causes for reading failure will be detected, such as deficiencies in the endocrine gland functionings.

At approximately the same time, Frank M. Lachman[20] hypothesized in 1960 that reading retardation is characterized by perceptual-motor immaturity, a type of developmental lag. To test his hypothesis he selected three groups of forty subjects between the ages of eight and eleven years of age with average intelligence rating on the Wechsler Intelligence Scale for Children, Binet, or Kuhlman Anderson.

Group R consisted of forty children who scored below the twentieth percentile on the California Reading Test. Group E was a group of forty children who ranged average in ability, but who were slightly disturbed. Group N was a group of normal children. Each group was then given the Bender Gestalt Test of nine figures. The findings revealed that the distortions were more frequent in the reading disability children than in normal children.

Because of an observational study, the writer is in agreement with the findings that reading failure is related to motor immaturity.

In his doctoral dissertation, published in 1961, Lee B. Copple[21] hypothesized that motor development is correlated to the achievement reading skills. He used 105 white fifth grade boys who were administered the Lorge-Thorndike Non-Verbal I.Q. Test, the Gates Survey, Form 2, sociometric measures, and twelve motor achievement contributes to reading retardation.

This study is weak insofar as only a survey type silent reading test was administered, which would be invalidated by reading retardates

because of guessing factors. This hypothesis is based on observation of approximately 300 subjects each year for the past five years. Many children do not hesitate to mark an answer sheet even though they have not read the material. Therefore, definite conclusions cannot be reached.

One of the most recently published studies was conducted by Marion Fenwick Stuart[22] in 1963. Her work concentrated on the remediation of reading disability based on neurological findings. She employed both Cillingham's and Fernald's methods. Both have the same end in view, that is, "building association for words by linking auditory, visual, and kinesthetic avenues; but the procedures for achieving this goal differ."[23]

> Actual teaching experience shows that learning is facilitated and even made possible by the use of the sensory-motor avenues simultaneously, or in associated relationships. Among specific language disability children, these sensory-motor approaches are necessary if reading, spelling, or perhaps writing are to be effective; but because the masses of children in the ordinary classroom have diverse individual imageries, the public schools, especially should benefit from wide and persistent adaptation of carefully planned simultaneous and interrelated sensory-motor approaches for concrete and verbal learnings.[24]

The writer is both familiar and experienced with the sensory-motor avenues employed by Grace Fernald,[25] which have aided many children and adults in grasping the visual-perceptual tasks of reading.

Another study appeared in 1963. Both William Ofman and Morton Sheavitz[26] hypothesized that the increase in reading ability by retarded readers is a function of the addition of tactual kinesthetic cues to the learning process. To test the hypothesis, they used three matched groups of children. In condition A, eye-tracing, the subjects traced the word presented by visually following a moving point of life as it

followed the outline of the word. In condition B, finger-contact tracing, the subjects placed a finger upon the slide and traced the word, pronouncing it at the same time. In condition C, simple reading, the subjects merely read the words after the examiner pronounced it. The results of this study

> revealed no absolute difference between the scores for the eye-tracing and the finger-tracing conditions, but both of these methods were superior to the simple reading method in the learning of words as tested by a written recall task. It was speculated that the variable of which the learning to read by retarded readers as a function may be the attention variable, rather than the previously supposed tactual-kinesthetic one.[27]

The related research gives evidence to the existence of differing opinions and theories in this field, but the literature is stronger toward that fact that poor eye-hand coordination is a factor to be considered in reading retardation.

Therefore, according to Spache, "when the child's behavior and quality of performance during near-point tasks indicate lack of visual perception or hand-eye coordination, developmental training should be given."[28] In fact, Dr. G.N. Getman,[29] an optometrist, believes that he also has the specific coordination of eye movements necessary for acculturation, that is, left-to-right movement of the eyes and return sweep. This is especially true for the lower third of a class which requires training in eye movements.

Another empirical study was designed by Phyllis A. Katz and Martin Deutsch,[30] in 1963, to test the hypothesis that retarded readers would exhibit poorer performance than normal readers on a task requiring rapid attentional shifts between modalities.

To test the hypothesis, forty-eight Negro males drawn from first, third, and fifth grade classes of two New York City elementary schools at the beginning of the school year were divided into groups according to reading ability as determined by the Gates Advanced Primary Reading Test. The first graders were given a reading prognosis test to differentiate the good and poor readers. The Lorge-Thorndike Intelligence Test was administered. A bimodal reaction time apparatus employing four separate stimuli was utilized, (red and green light, high and low tone). The reaction was recorded for each response of thirty-three trials, after which one-minute delay was given, and then the trial period was resumed again until each subject received 198 trials. Several results were evident, the most important of which showed that interaction between the type of reaction time and reading level was significant at the .01 level indicating that retarded readers exhibit greater difficulty than normal readers shifting from one modality to another.

This experiment provided useful information, but one weakness in the study is the type of tests used to measure reading and intelligence. The reading test leaves room for guessing and the intelligence test requires some amount of reading skills.

In the following year, Vernon and Hani Van de Riet[31] conducted a study which was designed to test the hypotheses: that children with learning disabilities have significantly more difficulty in visual-motor coordination than children who do not have learning disabilities, and that educationally retarded children have a higher incidence of

brain damage or central nervous system disorders than children without learning disabilities.

The method used to test these hypotheses was to screen by means of school records ninety fourth, fifth, and sixth grade boys from Gainsville, Florida. The experimental or underachieving group was given the Stanford-Binet L-M Intelligence Test. The control or achieving group was matched with the experimental group on the basis of school, classroom teacher, grade, I.Q., and sex. All the subjects were administered the Ellis Visual Design Test. Results of this study indicate that the F ratio of 3.51 is not significant at the .05 level. Therefore, the research hypotheses were rejected.

This study suggests that underachieving children have primarily psychological rather than physiological problems. It implys that it is important for future research to determine whether the primary basis for reading retardation and general educational retardation is different.

In 1965, Jean Ayres[32] designed a study to discover and demonstrate relationships among the different kinds of sensory perception, motor acitivity, laterality, and selected areas of cognitive function. The sensory modalities to which the study was limited were vision, touch, and proprioception. Language functions were excluded.

Batteries of thirty-five perceptual-motor tests were administered individually to each member of the two groups. The experimental group of one hundred children from Los Angeles were selected on the basis of perceptual deficits which lead to learning problems. The control group of fifty children from Los Angeles were selected without reference to

academic performance and were matched for mean, variance, and range of mental age and sex. Scores which were intercorrelated were subjected to the r correlation while the Q-technique factor analysis was used for correlations between scores for the experimental group. Results show that five or six of the tests were interpretable as hypothesized behavioral correlates of patterns of neurological dysfunction. Therefore, the factors in the dysfunction group were not due to normal developmental processes.

This experiment leaves some questions unanswered and more specific recommendations need to be drawn up for further research or follow-up studies.

CHAPTER IV

PROCEDURE FOR THIS STUDY

Experimental Design

During the first semester of the school year, September, 1964 - January, 1965, applicants to the Marygrove College Reading Clinic were tested for: intelligence on the Wechsler Intelligence Scale for Children, reading on the Gilmore Oral Reading Test, vision on the Orthorater, hearing on the Audiometer, dominance on the Leavell, Hand-Eye Dominance Test, and Ocularmotor Skills on the Coding Subtest of the Wechsler Intelligence Scale for Children and the Ocularmotor Trainer.

After approximately fifty children whose chronological age ranged from ten years to thirteen years had been tested, twenty were selected from this population. They were matched by pairs for chronological age, intelligence rating, sex, race, and ocularmotor skills. The matched-pairs were randomly assigned to the experimental and control groups respectively as shown in Table 1. The mean chronological age for the experimental group was twelve years, one month, and for the control group the mean age was eleven years, nine months; the mean intelligence quotient for the experimental group was ninety-nine and nine-tenths, and for the control group it was ninety-eight and six-tenths; the Coding Subtest of the Wechsler Intelligence Scale for Children for the experimental group was eight and two-tenths, the control group was eight and six-tenths; the Ocularmotor Trainer standard score was forty-nine

TABLE 1

VARIABLES USED TO MATCH PAIRS

Experimental Group						Control Group					
S.C.*	C.A.	Sex	I.Q.	C.S.**	O.M.***	S.C.	C.A.	Sex	I.Q.	C.S.	O.M.
1a	10- 9	M	103	7	48	1b	10- 6	M	102	9	52
2a	13- 5	M	108	10	54	2b	12- 6	M	108	10	54
3a	12- 8	M	95	9	56	3b	12- 7	M	95	10	48
4a	10- 8	M	112	10	46	4b	10- 5	M	109	10	52
5a	13- 3	M	92	7	56	5b	12- 8	M	92	7	53
6a	13- 6	M	90	6	41	6b	13- 5	M	93	6	51
7a	13- 0	M	99	7	55	7b	13- 4	M	95	8	42
8a	10- 8	F	109	13	53	8b	10- 9	F	99	15	61
9a	11-10	M	94	7	47	9b	11-10	M	96	8	46
10a	11-10	M	97	6	48	10b	11- 0	M	97	4	40
MEAN	12- 1		99.9	8.2	49.9		11- 9		98.6	8.6	50.4

* Student Code Number
** Coding Score
*** Ocular-Motor Score

and nine-tenths for the experimental group and fifty and four-tenths for the control group.

After the twenty children were randomly assigned to the experimental and control groups, the experimental variable was introduced for the ten children in the experimental group. Since the reading therapy is on an individual basis, seven teachers were involved with the study. Each teacher with the exception of one was given one pair of subjects. The subjects were given thirty hours of reading therapy twice a week for fifteen weeks. The experimental group was given a ten minute period of Ocularmotor Training during each session. The Ocularmotor Trainer has been described in Figure 1.

At the end of the semester, May, 1965, the groups were retested for oral and silent reading on equivalent forms of the reading tests from the first testing period.

Analysis of Data and Findings

The second operational hypothesis proposed in this was concerned with the effects of ocularmotor training in improving general reading achievement. As stated earlier, the hypothesis was:

> To investigate the probability that through the use of the Ocularmotor Trainer, greater improvement in total reading achievement can be obtained through the use of usual procedures alone.

The results of the oral reading accuracy scores and the total reading achievement scores administered before reading therapy in February, 1965 were compared with the tests administered in May. The null hypothesis, that there was no statistically significant positive difference between

the experimental group and the control group was imposed:

$$H_0 : \mu_1 \leq \mu_2$$

The research hypothesis was, then:

$$H_r : \mu_1 > \mu_2$$

Since direct control was used with five variates in the matched-pairs, the analysis of variance was used to test the significance of difference. It was not necessary to utilize statistical control over the variates because the pairs were so closely matched.

The data resulting from the comparison of the initial oral reading accuracy grade scores with the final grade scores are summarized in Table 2. The oral reading mean difference score for the experimental and control groups are designated $\bar{Y}_1$ and $\bar{Y}_2$ respectively. The means for this single factor experiment were 1.38 and 1.05. The observed F ratio for the analysis of variance was 1.6278. The critical value for a .01 level test for eighteen degrees of freedom is $F_{.99} = 8.29$. The observed F_1 therefore, of 1.6278 accepts the null hypothesis, and the research hypothesis of significance of difference may be rejected.

Total reading achievement scores were also tabulated for difference. Total reading achievement includes both oral and silent reading. Table 3 summarizes the results of total reading achievement grade scores. Again, the total reading achievement mean difference score for the experimental and control groups are designated $\bar{Y}_1$ and $\bar{Y}_2$ respectively. The means for the single factor experiment were 1.55 and .96. The observed F ratio for the analysis of variance was 2.559. This observed F, therefore, accepts the null hypothesis at a .01 level. It does, however,

TABLE 2

RAW SCORE DATA: ANALYSIS OF VARIANCE
FINAL ORAL READING ACCURACY DIFFERENCE

Experimental Group		Control Group	
Student Code No.	Grade Score Difference Y_1	Student Code No.	Grade Score Difference Y_2
1a	1.0	1b	.9
2a	2.8	2b	.9
3a	.9	3b	- .3
4a	1.7	4b	1.4
5a	1.3	5b	.8
6a	1.6	6b	2.2
7a	.7	7b	.2
8a	1.2	8b	.8
9a	1.5	9b	1.4
10a	1.1	10b	.5

$n_1 = 10$ $T_{Y_1} = 13.8$ $n_2 = 10$ $T_{Y_2} = 10.5$

$\sum Y_1^2 = 22.18$ $\bar{Y}_1 = 1.38$ $\sum Y_2^2 = 13.91$ $\bar{Y}_2 = 1.05$

$N = 20$ $\bar{\bar{Y}} = 1.215$ $GY = 24.3$ $\sum(Y)^2 = 36.09$

$1Y = 29.52$ $2Y = 36.09$ $3Y = 30.069$

$SYY = 6.56$ $EYY = 6.021$ $TYY = .5445$ $F = 1.6278$

TABLE 3

RAW SCORE DATA: ANALYSIS OF VARIANCE
FINAL TOTAL READING ACHIEVEMENT DIFFERENCE

Experimental Group		Control Group	
Student Code No.	Total Reading Difference Y_1	Student Code No.	Total Reading Difference Y_2
1a	1.1	1b	.9
2a	3.3	2b	.7
3a	1.3	3b	- .5
4a	1.9	4b	2.2
5a	2.3	5b	1.1
6a	1.4	6b	2.3
7a	.7	7b	.2
8a	1.1	8b	.6
9a	1.8	9b	1.5
10a	.6	10b	.6
$n_1 = 10$	$T_{y_1} = 15.5$	$n_2 = 10$	$T_{y_2} = 9.6$
$\sum Y_1^2 = 29.95$	$\bar{Y}_1 = 1.55$	$\sum Y_2^2 = 15.40$	$\bar{Y}_2 = .96$
$N = 20$	$\bar{Y} = 1.255$	$GY = 25.1$	$\sum(Y)^2 = 45.35$
$1Y = 31.5$	$2Y = 45,35$	$3Y = 33.241$	
$SYY = 13.85$	$EYY = 12.11$	$TYY = 1.74$	$F = 2.559$

reject the null hypothesis at slightly less than the .10 level. The critical level of $F_{.90}$ is 3.01.

From the results of the analysis of variance, both tables do indicate positive, but not significant, results in this study. With a larger population, fewer teachers to control teacher variables, and a longer term of training ocularmotor skills, more significant positive results will probably ensue.

CHAPTER V

CONCLUSIONS, LIMITATIONS, AND IMPLICATIONS

Resume

The purpose of this study was to investigate the probability that through the use of an Ocularmotor Trainer greater improvement in total reading achievement, by lessening reading disability in left-to-right direction and return sweep, can be obtained than through the use of usual teaching procedures only.

Twenty children between the ages of ten and thirteen who had been diagnosed at the Marygrove College Reading Clinic were pair matched for chronological age, race, sex, intelligence quotient, and ocularmotor skills. They were randomly selected for group assignment. Both groups were given individual reading therapy for two hours a week for fifteen weeks. The experimental variable of ten minutes training during the hour session on the Ocularmotor Trainer was imposed upon the experimental group.

In measuring the difference of scores on the preliminary test with the final tests in May, an analysis of variance was used in which an F ratio test of significance was employed.

Conclusions

The results of the enalysis of data with respect to oral reading accuracy improvement and total reading improvement warrant the following

conclusion:

That training on an Ocularmotor Trainer can positively result in greater reading achievement than through the use of usual procedures.

Limitations

In any attempt to extend the findings and interpretations of this experiment certain limitations must be considered:

1. That the ten minute period twice a week for fifteen weeks was too short a duration to develop a physical skill to be applied to reading achievement.
2. That the matched-pairs were too few to represent the population of retarded readers.
3. That the normal human variables of teachers should be considered in the total study. Subjectivity in evaluating reading performance from day to day lessens or strengthens motivation for the following day.

Implications

Certain practical implications for the education of children seem to be implicit in the conclusions of this pilot study:

1. That left-to-right direction and return sweep are physical skills that should be developed as part of a reading readiness program.
2. That lack of ocularmotor skills is related to reading achievement.
3. That ocularmotor skills are related to letter and word discrimination skills.

Since this pilot study was limited in its population and duration, its

results should be verified through replication on a larger population and for a longer duration which would be at least one school year.

APPENDIX A

OCULARMOTOR TRAINER RECORD FORM

Name_____ Grade_____

Date of Test_____ School_____

Date of Birth_____ C.Age_____ Race_____

Plate No. Total Time	Stand.Score	No. Contacts	Stand.Score	Remarks
Total Standard Score				
Mean Standard Score				

FOOTNOTES

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[8]Samual T. Orton, "Specific Reading Disability-Strephosymbolia," Journal of the American Medical Association, (April 7, 1928), 1095-1099.

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[21]Lee B. Copple, "Motor Development and Self-Concept As Correlates of Reading Achievement," Dissertation Abstracts, 22 (1961), 1241-1242.

[22]Stuart, op. cit.

[23]Ibid., p. 19.

[24]Ibid., p. 122.

[25]Grace M. Fernald, Remedial Techniques in Basic School Subjects (New York: McGraw-Hill Book Company, 1943).

[26]William Ofman and Morton Sheavitz, "The Kinesthetic Method in Remedial Reading," The Journal of Experimental Psychology, 31 (March, 1963), 317-320.

[27]Ibid., p. 320.

[28]George D. Spache, Reading in the Elementary School (Boston: Allyn and Bacon, Inc., 1964), p. 155.

[29]G.N. Getman, O.D. "The Four L's of Learning," Meeting on Visual Development in Children (Detroit: Wayne State University, April 20, 1964).

[30]Phyllis A. Katz and Martin Deutsch, "Relation of Auditory-Visual Shifting to Reading Achievement," Perceptual and Motor Skills, XVII (October, 1963), 327-32.

[31]Vernon and Hani Van de Riet, "Visual-Motor Coordination in Underachieving and Normal School Boys," Perceptual and Motor Skills, XIX (December, 1964), 731-734.

[32]Jean Ayres, "Patterns of Perceptual-Motor Dysfunction in Children: A Factor Analytic Study," Perceptual and Motor Skills, (1965), XX, 335-368.

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